Potential Flood Mapping by Height Above Nearest Drainage

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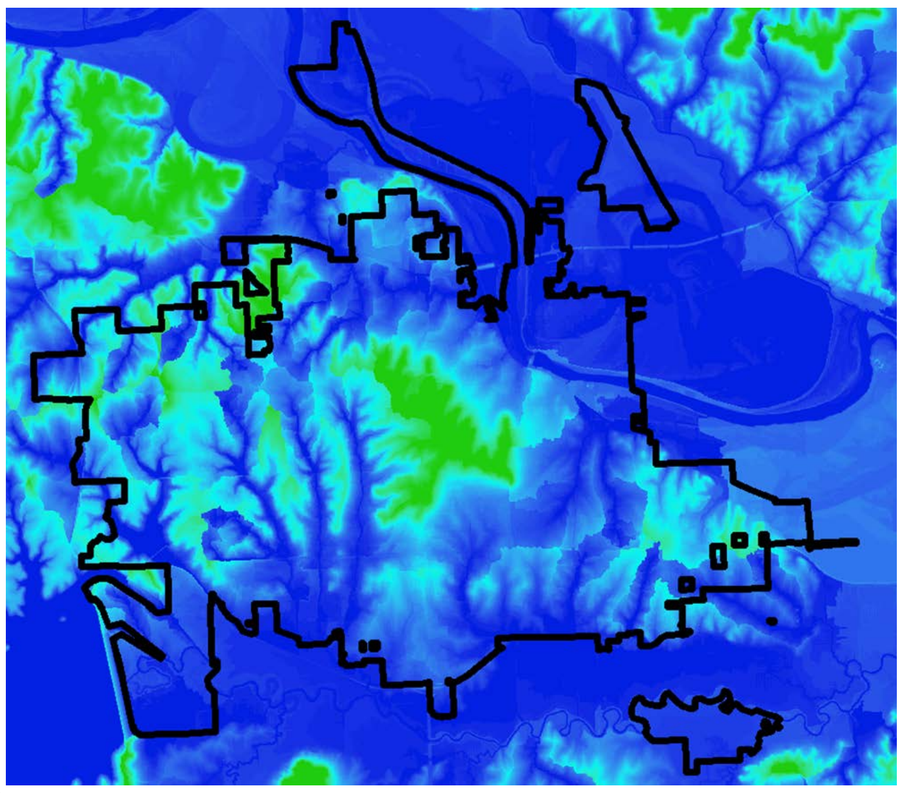
Introduction

Flood mapping is a complex process which requires the application of hydrology and fluid dynamics. The Height Above Nearest Drainage (HAND) raster is a relatively new GIS method which designates cell values for the height of the terrain in the cell compared to the closest drainage of that cell. Therefore, drainage areas are designated the value 0, and all other cells are assigned the value of their height above the nearest drainage.

The focus of this project is to determine if the HAND raster can be used to rapidly produce reliable flood maps in response to flooding events by using the HAND raster values to "imitate" flood heights.

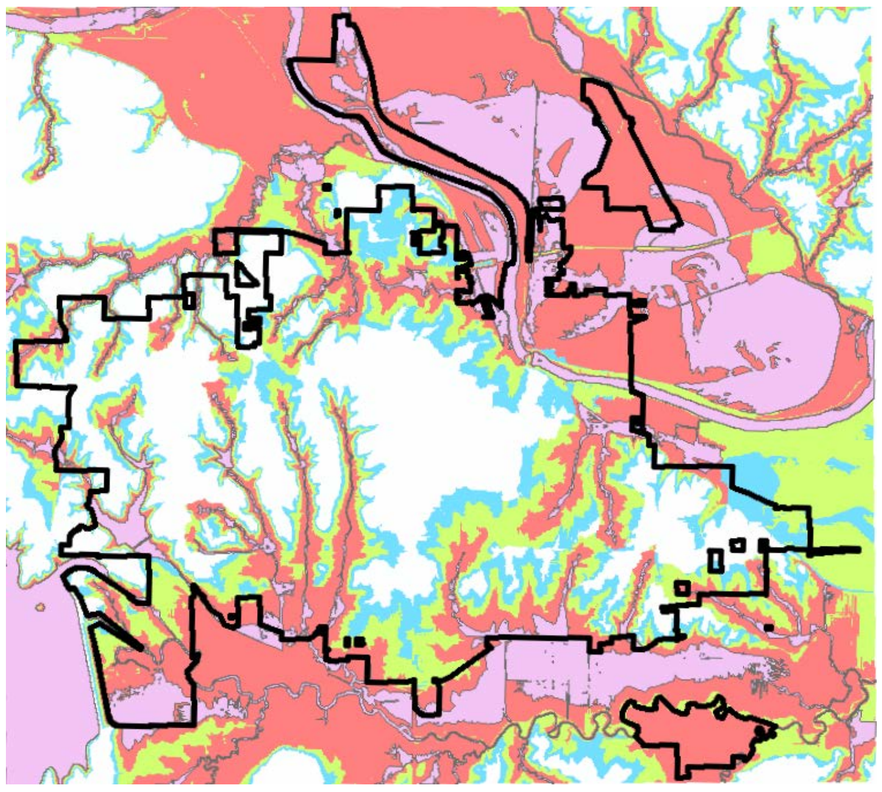
The figure below shows the official Lawrence city limits outlined in black, and the HAND raster of the city and immediately surrounding area. HAND values are shown ranging from blue (low heights) to green (high heights).



Methods

Vector data for the Lawrence city limits was used to clip the data for the road systems and building footprint to the Lawrence area. The HAND raster was converted to polygons based on height values, producing a polygon for each height. This allows heights to be easily selected from the layer to produce new layers. For example, to make a 10 meter layer, all polygons corresponding to a HAND value of 10 or less are selected, and a new layer is created from this selection.

Each of these layers for heights above drainage can be used to make a preliminary "flood inundation" map. The figure below shows the Lawrence city limits outlined in black, and the HAND raster polygons for the 0 height (drainage, pink), and 5 (red), 10 (green) and 15 (blue) meters above drainage. As expected, the area covered by each layer increases with increasing heights.



Results

An example of a map using a 5 meter HAND raster height is displayed at the bottom left.

HAND inundation is still an experimental method, and accuracy assessments of the product are still ongoing. To determine the accuracy of the HAND raster imitated "flooding" heights, these maps will need to be compared to official FEMA flood plain data. As of the time of this presentation, this is still a work in progress.

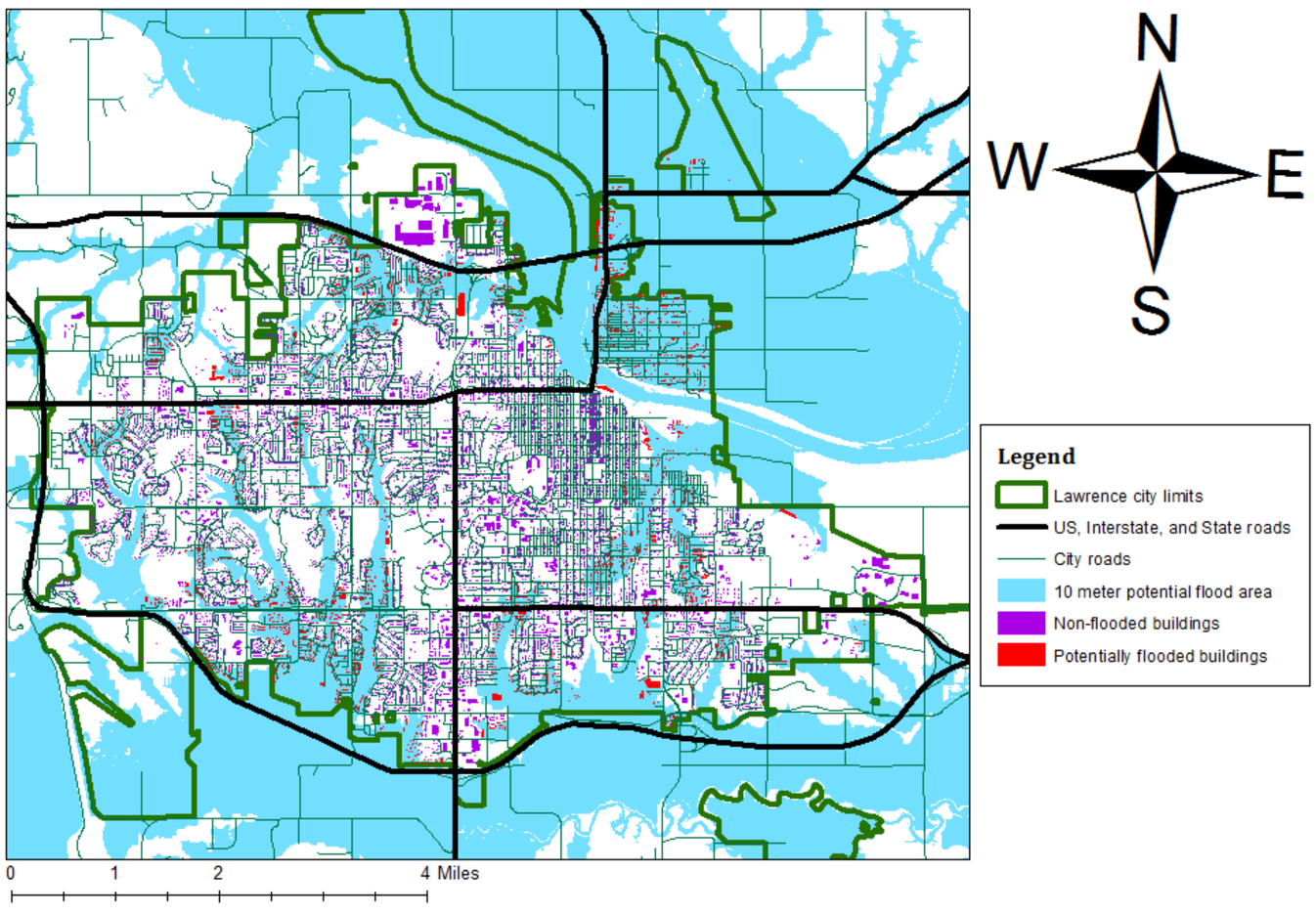
Conclusions

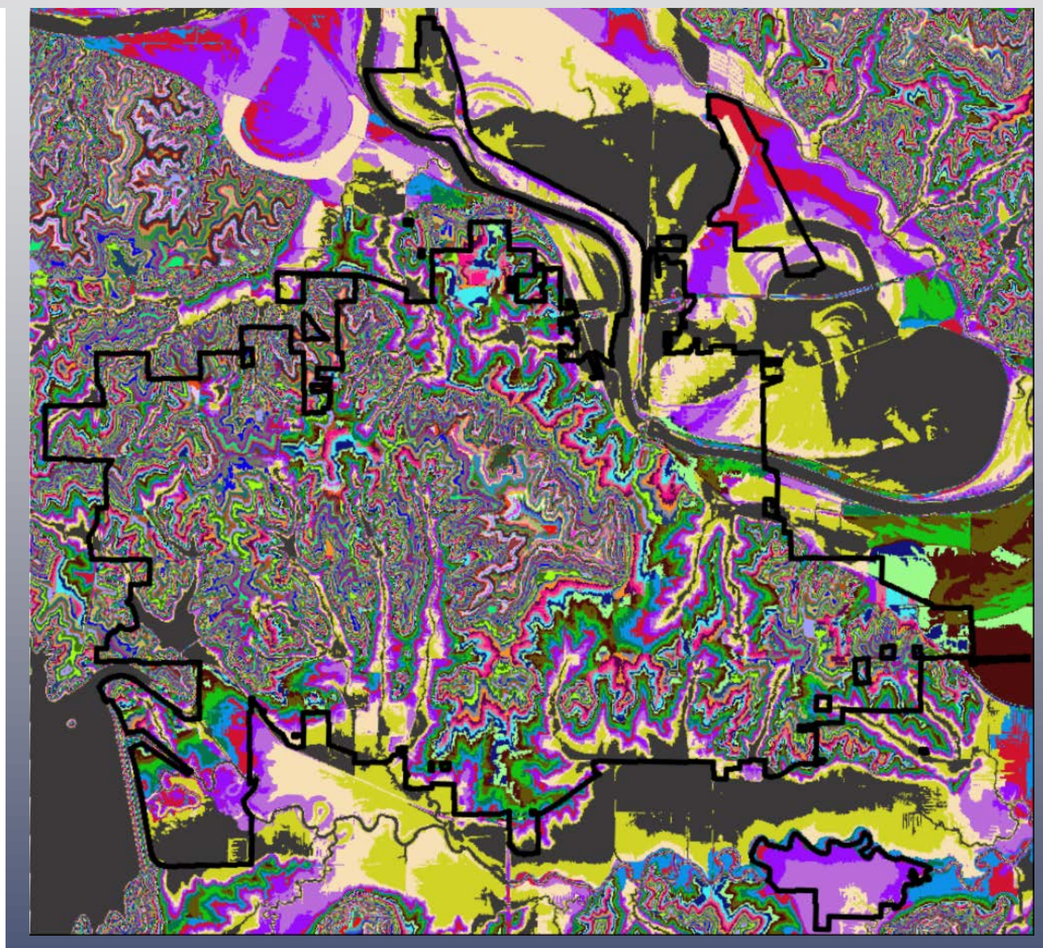
The produced maps show that the concept of using the HAND raster to create quick and unofficial flood maps for emergency use may be viable. However, until a comparison to official flood maps is made, this is still conjecture.

Good candidates for this comparison are the National Flood Hazard Layer and FEMA 100 year flood zone maps. The comparison will be done by determining the overlapping areas as percentages of the total flood area.

References

1. City of Lawrence. City Maps. (2015). lawrenceks.org/maps/#gis-data
2. ESRI. HAND_HUC6-102701. (2016). arcgis.com/home/webmap/viewer.html?webmap=8f369fda00b149cd9f043b29d582713d&extent=-153.0606,13.4862,-50.3165,56.213
3. Kansas Department of Transportation. Road Systems. (2012). Kansasgis.org/catalog/index.cfm?data_id= 275 &show_cat=12





The figure above is the HAND raster before conversion to polygon. This view accentuates the individual height levels, and shows more clearly how the area expands as heights increase above drainage. The black outline is still the official Lawrence city limits.